What Causes a "Blue Moon?"

By Tom Salem, Science Operations Officer

The expression "once in a blue moon" means something is not common or it rarely happens. So how often do blue moons happen and what is a blue moon? Is the blue moon a moon that is the color blue, is it a special full moon, or is it a sad moon? The moon does not have feelings, so that eliminates the moon being sad. But what about the other two options?

The second full moon of a single month is commonly called the "blue moon;" so it is a special full moon. Two full moons in one month happen about every 3 years. The next blue moon after this year will occur in June, 2007. There were 2 full moons during the month of July in 2004. The first occurred on July 2 and the second on July 31. So, the full moon on July 31 was our "blue moon."

The moon on July 31 would've been white, just like most other full moons, but can there be a moon blue in color? The answer is yes, the last known blue moon was observed in Edinburgh, Scotland, in September 1950--truly a rare event. One of the observers was an astronomer, Robert Wilson of the Royal Observatory. Mr. Wilson took measurements and concluded the moon was blue because the moon light was going through a cloud of small particles from forest fires in Alberta, Canada, which had come across the Atlantic ocean (according to the book Clouds in a Glass of Beer by Craig Bohren, 1987).

The color of the moon is essentially white or a combination of all colors. The moon observed high in the sky is almost always white, because there path of the moon light through the atmosphere goes through the fewest amount of atmospheric particles. The more particles—air molecules, water vapor, and pollutants—light comes in contact with the more light is scattered away. Most atmospheric particles scatter blue light first, because the particles are smaller than the wavelength of the light (about 500 nanometers or 1/100,000 inch). So the moon on the horizon—where the light has gone through more atmospheric particles—has lost most of its blue color and thus appears many times an orange or red color.

Most atmospheric particles are smaller than the wavelength of visible light, so the blue light is scattered first. Particles with sizes greater than the wavelength of light (for example, cloud droplets) will scatter all the colors of light equally. Yet, particles about the same size have the wavelength of light will scatter red light first. Very few particles in the atmosphere are the same size as the wavelength of light. So to see a blue moon is rare indeed.

Do you have a meteorologically related question you would like to ask? If so, email Thomas.Salem@noaa.gov, and we will cover it in the next edition of "Under the Big Sky."